RESERVE COPY

PATENT SPECIFICATION

525,686

Application Date: Feb. 25, 1939. No. 6290/39.

Complete Specification Accepted: Sept. 3, 1940.

COMPLETE SPECIFICATION

Improvements in or relating to Gas Burners

Communication from COPPUS ENGINEERING CORPORATION, a Corporation organised under the Laws of the State of Massachusetts, United States of America, of 344, Park Avenue, Worcester, Massachusetts, United States of America.

I, ARTHUR HAROLD STEVENS, B.Sc. (Lond.), F.C.S., Fellow of the Chartered Institute of Patent Agents, a Subject of the King of Great Britain, of the Firm of Stevens, Langner, Parry & Rollinson, of 5—9, Quality Court, Chancery Lane, London, W.C.2, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to a burner for natural gas, or other gaseous fuel supplied under pressure, such as atomized oil mixed with steam.

One object of the invention is to provide a rotating gas-discharging device whose rotation, preferably produced by the pressure of the fuel itself, not only obtains the delivery, for admixture with the gas, of the proper amounts of combustion-supporting air, but also causes a mechanical mixture of the gas and air so complete as to assure substantially instantaneous and complete combustion of the gas in the furnace or other apparatus wherein the gas is burned.

Another object of the invention is to provide a rotating gas-discharge device from which the gas is discharged at a plurality of different radial distances from the axis of rotation, thus making the mechanical mixing effective over substantially the entire cross-sectional area of the air stream, whereby the flame is of uniform intensity throughout, without any dead spots.

A further object of the invention is to provide a burner which mixes the gas and air so thoroughly as to eliminate the "blow torch" action usually involved in the use of burners for gas under pressure.

The invention provides a gas burner having a casing and a gas-conveying conduit within said casing, and including a rotatable member positioned within said casing and means for drawing a current of air transversely through the plane of rotation of the rotatable member, said member being adapted to discharge gas over the entire cross-sectional area of the air current so as to produce a complete and homogeneous mixture of gas and air throughout said cross-sectional area.

Also according to our invention there is provided a gas burner having a casing and a gas-conveying conduit within said casing, and including a rotatable member positioned within said casing and provided with apertures connected with said conduit for discharging the gas into the plane of rotation of said member, and means connected to said rotatable member for drawing a current of air transversely through said plane of rotation, the apertures being arranged so as to discharge the gas over the entire cross-sectional area of the air current to produce a complete and homogeneous mixture of gas and air throughout said cross-sectional area.

In order that the invention may be clearly understood and readily carried into effect, the same will now be described more fully with reference to the accompanying drawings in which:

Figure 1 is a central vertical section illustrating one form of the burner of our invention;

Figure 2 is a vertical transverse section taken on the line 2—2 of Figure 1;

Figure 3 is a vertical transverse section taken on the line 3—3 of Figure 1;

Figure 4 is a horizontal section, to an enlarged scale, taken on the line 4—4 of Figure 1;

Figure 5 is a side elevation of the rotary element of the apparatus, portions thereof being broken away and shown in section;

Figure 6 is a central vertical section illustrating a modified form of the invention;

Figure 7 is a section on an enlarged scale, taken on the line 7—7 of Figure 6;

Figure 8 is a fragmentary elevation of reaction turbine members forming parts

BEST AVAILABLE COPY

of said modified form of burner, the anterior half of an enclosing casing being removed to illustrate details of construction;

Figure 9 is an elevation of a modified form of propeller adapted to be substituted for the propellers shown in Figure 6; and

Figure 10 is a section taken on the line 10—10 of Figure 9.

Referring to Figure 1, the rotary element, designated 6, of our improved burner is shown as mounted in a suitable casing 7, the latter at its inner portion, to the left of the rotary mixing device 6, communicating in any desired manner with the combustion space of a furnace or the like, not shown, wherein the gaseous mixture is burned. The air for supporting such combustion is admitted to the casing 7 at the latter's right hand end; if desired, said right hand or outer end of the casing may be provided, as shown in Figure 1, with means for regulating or controlling the amount of air admitted. However, since this air controlling means by itself is not the subject of the present invention, a detailed description thereof is unnecessary; it is sufficient to note that in the form here shown, said air controlling means embodies an annular member 11 secured by bolts 12 to the end of casing 7, said member 11 having a series of apertures 14, 14 therein with which are registerable similar apertures 17 of a surrounding rotatable annular member 16 (see Figure 2). The quantity of air admitted thus depends on the angular position to which the member 16 is adjusted; additional air may be admitted to the casing 7 by way of apertures 19 in end plate 18 of member 11.

The mixture-forming member 6 is here shown as rotatably mounted on the inner end of a pipe or conduit 20, the latter communicating at its other end with a source of gas under pressure; said conduit 20 passes through an opening 21 of plate 18 and is held and centred in the casing 7 by means of a spider 22, which fits snugly in the casing 7, as shown in Figure 1. A set screw 23 locks the conduit 20 in the hub 24 of the spider 22. A port 25 is provided in the conduit 20 and is screwthreaded to receive a suitable lubricator 26, which furnishes a small amount of lubricant to the gas stream; this lubricant is conveyed by the stream to lubricate the various moving parts of the burner contacted thereby.

The rotary device 6 is formed in part by a cup-shaped member or hub 27 mounted by ball bearings 28 to rotate on the outer periphery of the conduit 20. The other member 29 of device 6, is suitably connected by a flange 30 to the outer end of the hub member 27 to rotate therewith. It will be apparent that the member 29 is, in effect, a hollow shell or cup, opening directly to the gas under pressure in the conduit 20, and forming a reservoir from which the gas is forced in various directions to be mixed mechanically with air drawn into the casing 7 by rotation of the device 6.

Extending radially from the rim of the member 29 are a series of hollow arms 31, 32, 33 and 34. In this case, only four of these hollow arms are shown, although it is obvious that any desired number may be provided, to communicate with the interior of the member 29. These arms are hollow shells, suitably secured to the member 29 or they may be formed integral therewith. They are designed to provide propeller blades 36 in the conventional manner of fan blades so as to cause, by their revolutions, a longitudinal movement of air through the casing 7 in quantities proportional to the speed of rotation of the device 6.

The rotation of said device 6 is in response to or by way of reaction to the issuance of streams of gas under pressure from the several arms 31, 32, 33 and 34, the gas discharging into casing 7 through certain orifices which are of the requisite size, number and arrangement to furnish the desired amount of fuel to the combustible mixture. It will be understood, of course, that the gas conduit 20 may be provided with the usual regulating valve (not shown) which is operable to control the pressure and amount of gaseous fuel which issues from the orifices of the rotating device 6. In the embodiment of our invention shown by Figures 1 to 5 inclusive, we have provided the device 6 with three different kinds or types of gas-discharging orifices, as follows:—

A series of radially spaced orifices 35 is drilled or otherwise formed in each of the hollow arms 31, 32, 33 and 34, all these orifices 35 being substantially in a common plane transverse to the axis of rotation of the device 6, and arranged on corresponding sides or surfaces of the several arms, as indicated in Figure 3 of the drawing. These orifices 35, being substantially tangential to the rotation imparted by the issuing gas streams may be considered as the main propelling orifices which, by their direction, diameter and spacing from the axis of rotation determine in large measure the direction and speed of rotation of the device 6. The air propelling wings or fan blades 36 are here shown as integral with the hollow arms 31, 32, 33 and 34, but obviously our invention is not limited to this arrange-

BEST AVAILABLE COPY

ment; according to our invention, said blades or wings 36 may be attached to the rotating structure 6 in any way or at any place desired,—so long as they serve their function of causing the flow through casing 7 of an adequate supply of combustion-supporting air in a current or stream which cuts the gas streams issuing from orifices 35, 35 substantially at right angles.

A second series of radially spaced apertures 37, drilled or otherwise formed at appropriate angles to the orifices 35 in each of the hollow arms 31, 32, 33 and 34, may be considered primarily as "flow orifices" intended not so much to produce rotation of the device 6 as to direct greater amounts of gas into the casing 7 than would escape through the main propelling orifices 35. Finally, a series of orifices 38, formed in the member 29, serve to eliminate "drag" at the center of the burner, due to any degree of vacuum exerted at this center by the fan action of the blades and the rush of gas into the casing 7. Since the burner unit rotates normally at high speed, the gas escaping through the orifices 38 actually forms a cone rather than single jets; and this formation, added to the fan effect, assures very rapid mechanical mixing of the air and gas. The orifices 37 may also be considered as compensating orifices for the admission of gas, in excess of the gas that would flow into the casing through the propelling orifices 35, in amounts which would proportion the total flow of gas from orifices 35, 37 and 38 to ensure proper combustion by the immediate mixing of this gas with the air induced to flow into the casing 7 by rotation of the properly designed air-propelling wings or fan blades 36, 36.

A shield 39 is secured to the conduit 20 and surrounds the member 27, in such manner that any gas which leaks past the seal or packing between member 27 and the conduit 20 will be directed forwardly into the zone of gas and air admixture occupied by the revolving hollow arms 31, 32, 33 and 34.

In this zone of admixture, the mass of propelled air passing lengthwise of the casing 7 has mingled very intimately with the gas which is issuing in numerous relatively fine streams from the orifices 35, 37 and 38; the number and distribution or location of these orifices and the fact that they are carried rapidly around and around by the motion of the device 6, makes the zone of admixture practically coextensive with the cross sectional area of the casing 7. The intermingling of the two ingredients, air and gas, to form the combustible mixture takes place in this zone almost instantly, and in a practically uniform manner throughout,—being assisted and promoted not only by the travel in a circular path of each issuing gas stream, but also by the fact that the zone of admixture is being constantly traversed by the arms 31, 32, 33 and 34 themselves. The number, size, arrangement and direction of the gas-discharging orifices of the device 6 can be varied over a considerable range to best meet the requirements of different kinds and grades of gaseous fuels, but once these relations for a given fuel are established, the burner can be depended upon to produce invariably the desired homogeneous and uniform admixture of air and gas, regardless of fluctuations in the pressure or amount of gaseous fuel supplied thereto, since the quantity of air drawn through the casing by the fan blades 36 is always substantially proportional to the amount of gas issuing from the discharge orifices of device 6.

In actual practice it has been found that with our improved burner there is no need to make provision for any secondary combustion, as the mixture formed at or just beyond the rotating hollow arms 31, 32, 33 and 34 burns instantly and without visible flame, even in a cold furnace. Due to this complete mixing, with attendant dissipation of the pressure of the gas, the burner operates very quietly and with total elimination of furnace vibration. In the furnace the combustion mixture ignites and spreads out in a fan shaped area, due to the great increase in volume on ignition, and this eliminates what is known as "blow torch" action, which has always been present heretofore in furnaces equipped with burners using high pressure gas.

The burner described herein reduces the size of conduits required within the furnace room, since it is capable of burning gas at pressure as high as any gas main carries; and may be regulated in accordance with variations in such pressure. This burner also reduces the stack draft requirements over any other burner, since it makes its own forced draft, and it also allows for greater furnace rating since combustion is completed closer to the discharge than in other burners.

In the modification shown in Figures 6 to 8 inclusive, the conduit 20^1 replaces the conduit 20 of the first form of the invention. The burner head designated generally by the reference numeral 41 comprises a shell formed of members 42 and 43, provided with cooperating outwardly directed flanges 44 and 45 suitably secured to each other. The conduit 20^1 is shouldered to form a seat for a ball bear-

BEST AVAILABLE COPY

ing 46, secured against said shoulder by a lock nut 47.

The inner closed end of conduit 20^1 has a screwthreaded stud 48 projecting axially therefrom to form a shoulder seating the ball bearing 49, which is clamped against said shoulder by a nut 49^1. An annular spacer disk 50 is secured to the outer race member of the bearing 49, and is provided with apertures 51 leading to a chamber 52 formed between the disk 50 and the end wall of shell portion 43. A series of apertures 53 in this end wall permit the escape of gas into the casing 7.

The conduit 20^1 is provided with any desired number of radial apertures 54 leading to the inlet side of reaction turbine blades 55, 56, 57 and 58, secured in alternation to the conduit 20^1 and the shell formed by members 42 and 43. The wall of the chamber 59 formed in the member 43 is provided with radial apertures 60 through which the gas is discharged radially outward into the casing 7.

The gas under pressure passing through the turbine blading, as shown in Figure 8, causes rotation of the burner head. To said head, as shown by Figure 6, are secured a series of radial fan or propeller blades 61, 61 and these by their rotation draw into the casing 7 the necessary amount of combustion-supporting air for admixture with the gas discharge through the apertures 53 and 60. The various apertures exhaust the gas at all angles, from zero to right angles relative to the axis of rotation of the burner, and this insures a thorough mixing of the gas with the air of combustion drawn into the casing by the propeller or fan blades 61. These propellers 61 may, if desired, be replaced by the hollow propellers 62 (Figures 9 and 10) having gas-discharging slits 63 formed therein. Where these hollow propellers are used, the member 43, to which they are attached, will be provided with apertures 64 to permit the gas to pass into the propellers for discharge through the slits 63. This gas discharge through slits 63 promotes and assists in intermingling of the gas with the combustion-supporting air, but is not relied upon to produce by reaction the rotation of the burner head.

It is to be understood that the invention is not to be considered as limited to the specific construction and arrangement described herein, since it is evident that many changes may be made without departing from the scope of the invention as defined by the claims appended thereto.

Having now particularly described and ascertained the nature of my said invention (as communicated to me by my foreign correspondents), and in what manner the same is to be performed, I declare that what I claim is:—

1. A gas burner having a casing and a gas-conveying conduit within said casing, and including a rotatable member positioned within said casing and means for drawing a current of air transversely through the plane of rotation of the rotatable member, said member being adapted to discharge gas over the entire cross-sectional area of the air current so as to produce a complete and homogeneous mixture of gas and air throughout said cross-sectional area.

2. A gas burner having a casing and a gas-conveying conduit within said casing, and including a rotatable member positioned within said casing and provided with apertures connected with said conduit for discharging the gas into the plane of rotation of said member, and means connected to said rotatable member for drawing a current of air transversely through said plane of rotation, the apertures being arranged so as to discharge the gas over the entire cross-sectional area of the air current to produce a complete and homogeneous mixture of gas and air throughout said cross-sectional area.

3. A gas burner according to claim 1 or 2, in which the rotatable member comprises a plurality of hollow, radially extending shells each of which is provided with a row of gas-discharging orifices extending radially outwardly from the conduit and lying in a plane perpendicular to the axis of the casing.

4. A gas burner according to claim 3, in which each of the shells is provided with other apertures extending substantially parallel to the axis of the casing.

5. A gas burner according to claim 2 or 3, in which the means for drawing air through the plane of rotation comprise a plurality of fan blades positioned on the individual hollow shells.

6. A gas burner according to any one of claims 1 to 3, in which the rotatable member comprises a cylindrical body in communication with and mounted to rotate on the conduit, turbine blades being fixed in alternating annular rows to said conduit and cylindrical body respectively and operating by reaction pressure of the gas to rotate the cylindrical body on said conduit.

7. A gas burner according to any one of the preceding claims, in which the rotatable member comprises a cup-shaped head mounted on the end of the conduit and having a plurality of apertures arranged substantially parallel to the axis thereof to permit gas from said conduit to be discharged into the space formed by

BEST AVAILABLE COPY

the (ng at the inner end of said conduit.

8. A gas burner according to any one of the preceding claims, in which the source of gas under pressure includes valve controlled means for introducing a lubricant into the gas during its passage towards said burner.

9. A gas burner substantially as hereinbefore described and illustrated in the accompanying drawings.

Dated this 25th day of February, 1939.

For A. H. STEVENS,
Stevens, Langner, Parry & Rollinson,
Chartered Patent Agents,
5/9, Quality Court, Chancery Lane,
London, W.C.2, and at
120, East 41st Street, New York, U.S.A.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1940.

BEST AVAILABLE COPY

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

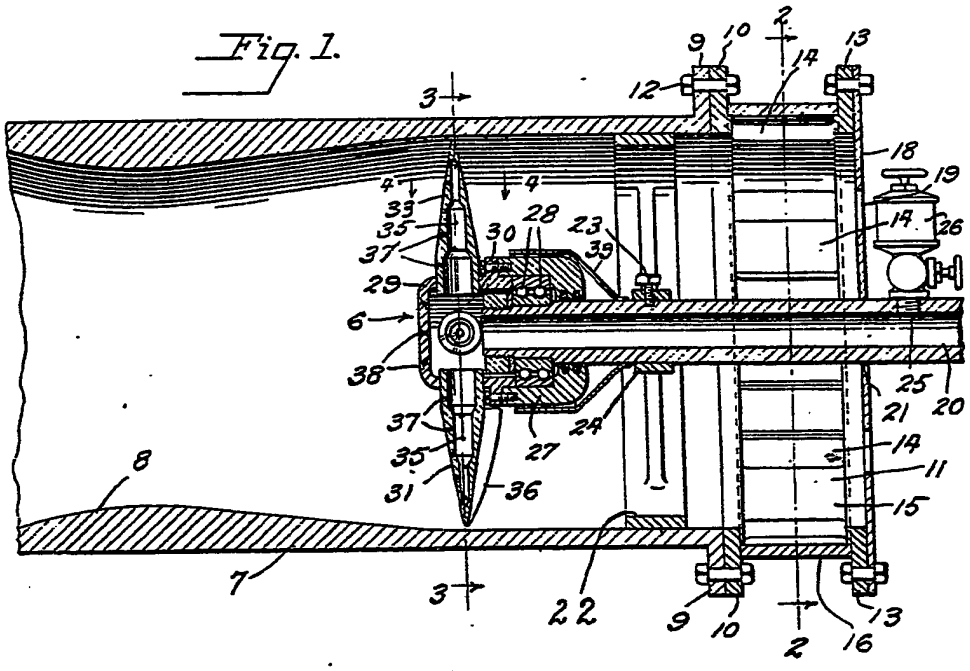


Fig. 4.

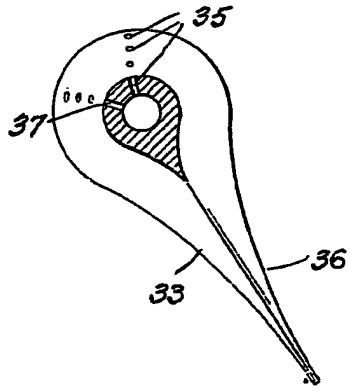
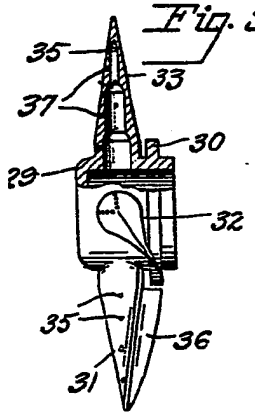


Fig. 5.



BEST AVAILABLE COPY

Fig. 2.

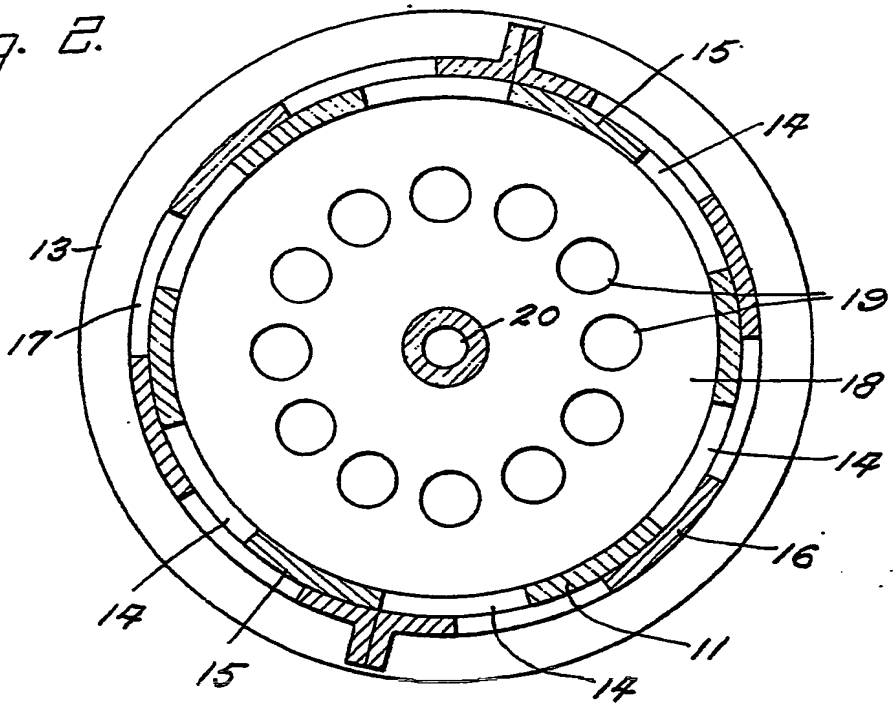
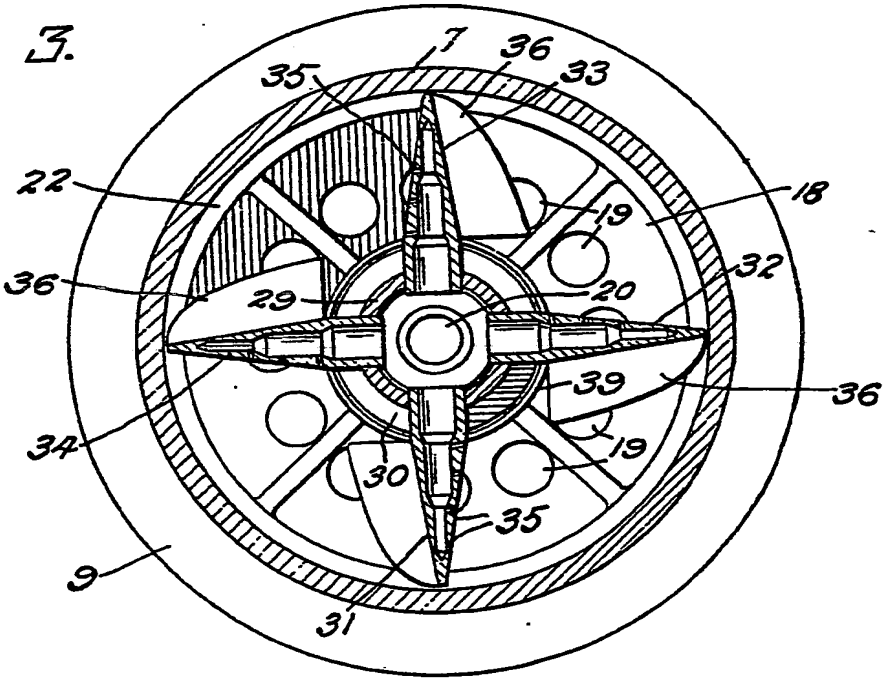


Fig. 3.



Malby & Sons, Photo-Lith

BEST AVAILABLE COPY

525,686 COMPLETE SPECIFICATION

3 SHEETS

SHEET 1

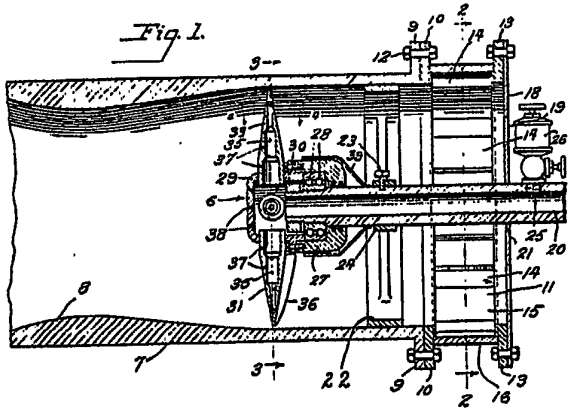


Fig. 1.

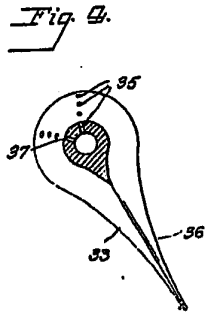


Fig. 4.

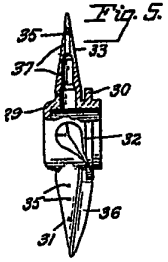


Fig. 5.

SHEET 2

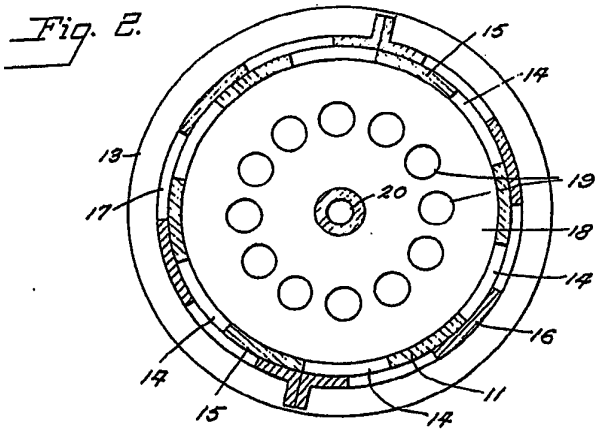


Fig. 2.

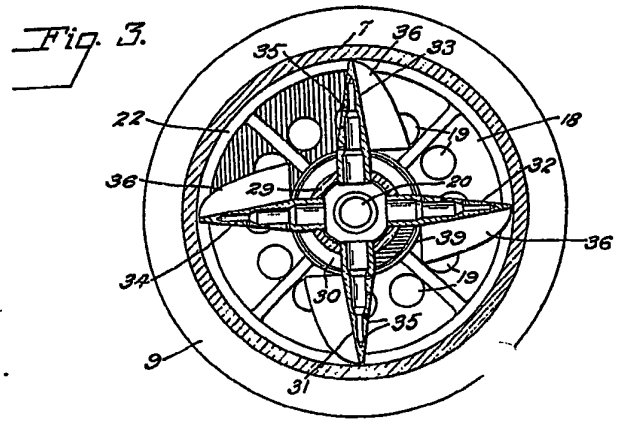


Fig. 3.

[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Lith

BEST AVAILABLE COPY

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 6.

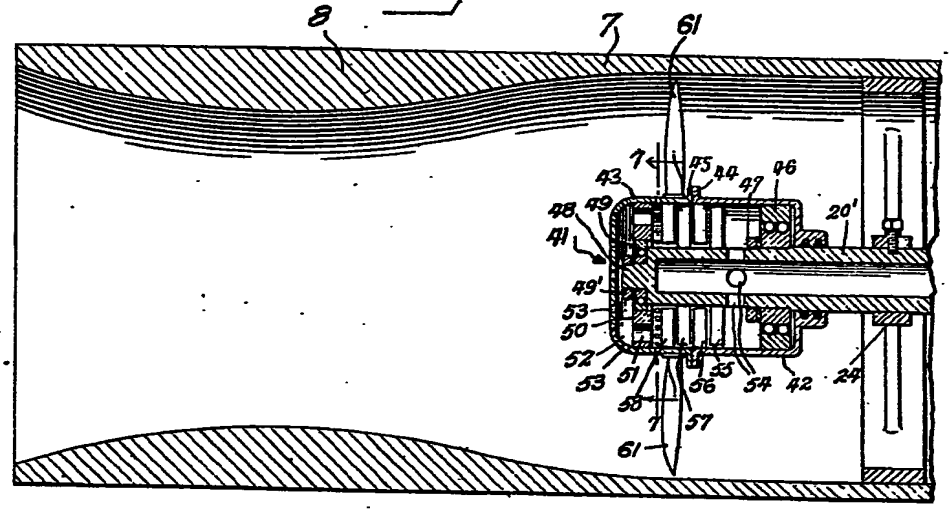


Fig. 7.

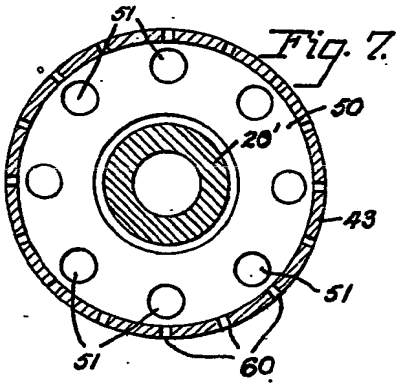


Fig. 8.

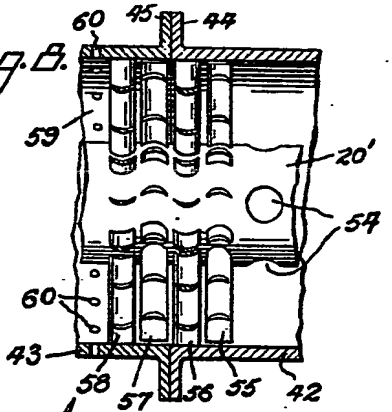


Fig. 9.

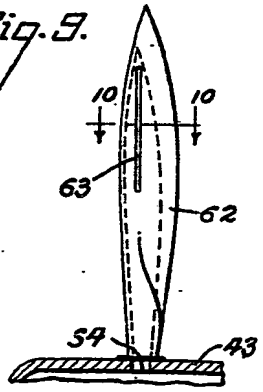
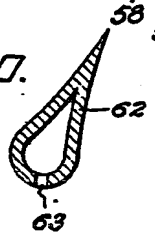


Fig. 10.



Malby & Sons, Photo-Lith.

BEST AVAILABLE COPY

THIS PAGE LEFT BLANK